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and Maintenance of Way

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IT IS the intention of the management of this journal to devote a column of each number to open discussions of minor points in maintenance work. This is to be carried on by the customary publishing of letters seeking for certain information and the subsequent answer or comment from other readers.

WE READ many long articles in the engineering papers on the duties of a Division Engineer as to what he should and should not do. For the "busy" man in such a position the articles will sum up very concisely into "continual observance and study" and the corresponding "proper application."

IT HAS been said that "coming events cast their shadows before." If the old saw has any force at this time it would appear that the monster train sheds are doomed to become extinct, by the adoption of much cheaper and equally efficient construction, of the type of the so-called umbrella sheds which extend over the station platforms. Of these there are two forms, either of which will serve their purpose, one of which simply affords protection to the platforms, extending but partially over the car roofs, while the other forms a continuous cover over platforms and trains, as in the case of the train shed roof. Either of these forms of construction have won a certain following in engineering circles which may presage the abandonment of the old form of sheds which has been a landmark in station construction since the earliest days of railway operation.

The old barn-like structures have served their purpose as a protection against rain and snow most admirably, but as a measure of immunity against gases and cold they have always been failures of the most pronounced type. In the latter regard, the umbrella form of construction, while equally as cold as the train shed, provides a remedy for the stifling effects of smoke and gas from arriving and departing locomotives, not to mention the deafening din from the unmuffled exhaust. Aside from the lesser cost of the umbrella form, there are believed to be many advantages not possessed by the older form. Good evidence that there are friends of the umbrella type, will be seen at the new terminal of the Delaware, Lackawanna and Western at Hoboken, and at the Washington terminal.

THE reputation of an engineer is sometimes, but very rarely, made in a day or week. It will be remembered how B. F. Loree sprang into prominence after his rebuilding in a single night a bridge washed away in the Johnstown Flood. By the same quick thinking and acting the engineers in charge of bridge work on the New York, New Haven & Hartford replaced a 500-ft. wooden trestle in just 18 days and 4 hours. The bridge No. 105 over the Housatonic River was destroyed by fire from a live clinker. The usual difficulties in taking care of men and equipment were encountered and overcome. Similar occurrences, while deplorable in their destruction, call forth the best qualities of the engineer in order to delay traffic as little as possible.

ALONG the line of third-rail traction, the New York Central & Hudson River Railroad recently discovered, due to peculiar weather conditions, almost conclusive evidence in favor of the under-running third rail. A light rain followed by hail and followed by rain again, with the temperature ranging from 28 to 33 degrees Fahrenheit and an east wind with a velocity of two miles an hour, brought out the proof. The effect on five different types of third rail was noticed, three under-running and two over-running.

The unprotected over-running rail became so badly covered with sleet as to be useless for running, inside of three hours. On the type of the protected incline over-running and of such a structure as to permit of wind to get at the rail, sleet had formed in many places, so that the contact shoes were arced badly as they passed over.

The under-running types, consisting of the wood protection, the fibre protection and the mica compound protection were all found free of any sleet, and hence permitted of free running while the over-running types as mentioned before were unsatisfactory. Such weather conditions of course may not be frequent but once protected against in a substantial manner reduce delays and cost of repairs to a minimum.

Comparative Development of Automatic Signaling in Europe and America

IN THE recent International Railway Congress at Washington an interesting feature of the development of automatic signaling gives food for considerable thought. The idea of automatic signaling was conceived very nearly at the same period in both America and Europe, but the wonderful progress made in this country has greatly exceeded that made in Great Britain and on the Continent. Mr. C. H. Platt, late general superintendent of the N. Y. N. H. & H. R. R., representing America's signaling, while M. Margot, of the P. L. M. Ry., of France, discussed the work from the European standpoint.

One of the drawbacks in Great Britain seems to be the conservative action of the British Board of Trade, whose approval must be general before a new system of signaling can be installed. This country, of course, having no restraining influence, is free to advance more rapidly in this line. As to the installations on the Continent which number about five, those giving the best results have been installed by American companies.

Santa Fe Tie Plant at Somerville, Texas

ONE of the "live" subjects today is the supply of ties for future renewals and not such a far away future either. The tie renewals on the Eastern Division of one of the larger systems alone, are estimated at something over 3,000,000 ties per year. To realize anything from trees planted for future tie production, not only requires many years but also necessitates the purchase and continued use of large tracts of land. The Santa Fe system has favored the tie treating process and have gone at the business very systematically in the last year or two. For nearly 20 years they have used the zinc chloride process, varying with an occasional change to the "Wellhouse" zinc-tannin. After this long use of the above-named process they finally have conceded the Creosote process, or rather a modification of it to be the preferred method. A large treating plant has been established at Somerville, Texas, and while incorporated as the Texas Tie and Lumber Company, it is in truth a Santa Fe enterprise. The "Rueping" process is used at this plant, which consists mainly of forcing air into the cells of the wood and then forcing in the impregnating fluid without dropping the pressure. The pressure used is gradually increased, varying, of course, on the nature of the wood, until a state of saturation is reached, the excess fluid being then allowed to drain off. Herein lies the commercial advantage of this process in that no more of the fluid is used than is absolutely necessary. In the equipment of the plant the impregnating and pressure cylinders embody the best construction for large pressures. Two large tanks are used for storing the creosote after it is pumped from a well into which the creosote has previously been run from cars. From the storage tanks the oil is passed into working tanks where it is brought up to the proper temperature. The creosote is then, by successive steps, carried through the pressure and impregnating cylinders and into the tie to be treated.

By an estimate on the chemical life of the creosote it is claimed that the preservation will last from 12 to 15 years in the case of the soft pine tie. The output of the plant is rated at 10,000 to 15,000 ties per day of 24 hours. It is on the success of just such a plant as this that the fate of the tie treating is dependent and the corresponding failure will have a great weight with engineers throughout the country.

Classification of Track

A MATTER causing considerable comment during the last annual meeting of the American Railway Engineering and Maintenance of Way Association and since was the report of the special committee on Classification of Track. The hardship of recommending a classification that would suit any considerable number of railroads is readily seen if one stops to think of the many different conditions of grades and traffic and the corresponding number of tracks available for the traffic operation. After an exhaustive investigation of some 87 roads, the following conclusions were drawn:

Class "A" shall include all districts of a railway having more than one main track, or those districts of a railway having a single main track with a traffic that equals or exceeds the following:

Freight car mileage over district, per year, per mile, 150,000.

Or passenger car mileage per annum per mile of district, 10,000.

With maximum speed of passenger trains of 50 miles per hour.

Class "B" shall include all districts of a railway having a single main track with a traffic that equals or exceeds the following:

Freight car mileage passing over district per year per mile, 50,000.

Or, passenger car mileage per annum per mile of district, 5,000.

With maximum speed of passenger trains of 40 miles per hour.

Class "C" shall include all districts of a railway not meeting the traffic requirements of Classes "A" or "B."

An interesting point developed by the committee, was the comparatively low rate for maximum speed of passenger trains. It must be remembeerd that this limit is for the average scheduled speed and not the actual running on particular parts of the road. The recommendations have been made with the idea that such as they are, they can be safely taken by a large majority of roads together with the particular kind of roadway previously recommended. Any departure from the traffic and speed requirements has been regarded as exceptional and the committee did not undertake to advise treatment for such special conditions.

However, there is considerable leeway in the report, since a road not conforming through the volume of its passenger traffic may do so under the freight classification and vice versa.

The Scranton Tunnel of the Lackawanna and Wyoming Valley Railroad

THE Lackawanna and Wyoming Valley Railroad is a third-rail double-track road operating through the northern anthracite coal fields of Pennsylvania from Scranton to Wilkesbarre. The entrance to Scranton was originally made over a hill on the southerly side requiring a heavy grade of 4 per cent. Later a tunnel was constructed as a permanent line through the hill to eliminate the 4 per cent grades. The first survey made was for a line under Irving avenue one block nearer the heart of the city than it was finally located, as shown by the accompanying map of Scranton (Fig. 1). This first line was run in order to take advantage of some old mine workings known as Dunmore No. 3 and was thought that it would prove an easy and cheap way of tunneling. However on closer investigation it was found to be impracticable since the drift was above and below the tunnel grade and crossed the profile twice. After a number of lines had been run and considered, it was finally located under property adjoining Crown avenue one block south of the original survey.

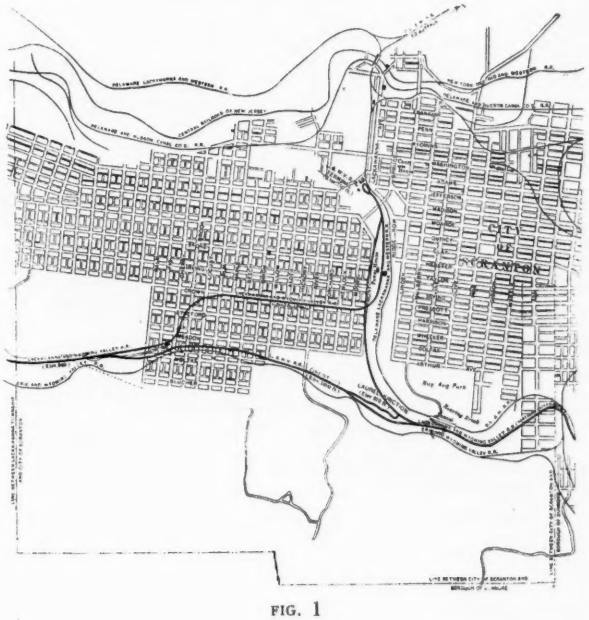


FIG. 1

From a knowledge of the geology of the land to be tunneled, it was known that the line would clear the working of the coal yet to be mined from Dunmore No. 3, but would encounter rock that would require some lining, how much was not known. The contract was let June 1, 1904, providing completion of the work to a condition admitting the laying of track throughout within sixteen months and under a penalty and bonus clause providing for the payments of $200 per day. Work was commenced July 5, 1904, after some trouble in securing the right-of-way, the first round of holes for the north portal being fired August 12, 1904, a month having been previously consumed in excavating the approach cut.

Six months' work showed conclusively that the rock was of such nature as would require lining almost continuously throughout the tunnel. In order to avoid the first cost involved in masonry lining, an exceptionally strong timber structure was devised for this work and used in about one-half of the entire length.

In the survey the usual difficulties accompanying similar work had to be overcome. A great many buildings were located on the center line of the surface, the ground also being very uneven made necessary the establishment of five permanent points on the Crown avenue base line. Two shafts were sunk a little off the center line of the line of the tunnel falling partly within and partly without the tunnel prism. The method of dropping the line in the shafts was simple but permitted accuracy under the proper care. Plumb bobs of about 30 pounds weight were suspended by copper wires from points about two feet above the top of the shaft lining. The wires were hung over a notched bolt, running through a V-shaped piece of iron, with a thumb-screw and spring adjustment. The plumb bobs were steadied in casks of oil or water at the bottom of the shaft, the casks being provided with covers so that the surface of the liquid would not be disturbed by dripping water. However, even with these precautions there were generally slight tremors in the wire, due to the falling water.

The lines met in the heading between the south portal and shaft No. 1, with a variation of 0.16 feet, between shafts Nos. 1 and 2 with a variation of 0.02 feet, and between shaft No. 2 and the north portal with a variation of 0.23 feet. In no case was the center line, as run from the shafts, more than 1⅞ inches away from the actual center line. The greatest variation in the grade as run was 0.07 feet, the larger part of the tunnel being run on a 1 per cent grade with the exception of a short piece of 0.8 per cent at the north end. Due to the hilly nature of the country, it was necessary to use curves at each end of the tunnel. At the north end, owing to a very narrow valley, a 10 degree curve with 400 foot spirals on each end was laid out, while at the south end, to connect the line of the existing track with the center line of the tunnel, a 4 degree, 14 foot curve with a spiral 218.75 feet long was run.

The excavation was made at six different points from the outer ends of the tunnel and each way from the two shafts. By means of these two shafts 56 per cent, or a little over half of the material, was taken out through the shafts, showing the great saving of time made by their use. Lines were given as the work progressed, allowing the top heading to be taken out to full size, 9 by 21 feet, the length carried ahead of the bench varying from 50 to 800 feet.

The material removed at the south end was loaded on cars and used as rip-rap at a point on the road about 16 miles away. The excavation from shaft No. 1 was dumped on low land nearby purchased for that purpose, that from shaft No. 2 was hauled by surface incline to a dump about 1,200 feet away and 50 to 60 feet higher, while the material taken from the north end was dumped

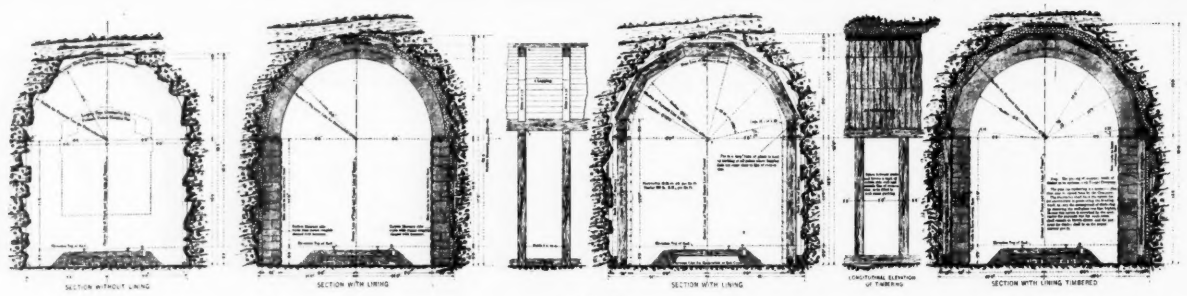


FIG. 2

along the bank of Roaring Brook. The work was carried on day and night by two ten-hour shifts.

In the lining of the tunnel, concrete masonry was used at each portal and at points where there was the greatest danger of the rock breaking off. At three different points the rock was found to be sufficiently strong as to require no lining. Timber lining was carried as far as possible in order to reduce the heavy cost of a masonry section. (See Fig. 2.) The following gives an idea of the proportionate makeup of the tunnel lining:

Plain rock section	1,305 ft.
Timber-lined section	2,717 ft.
Masonry section	725 ft.
Total	4,747 ft.

Since the tunnel has been constructed there has only been one fall of any considerable size.

Yellow pine timber has been used in the timber-lined section with the ordinary style of voussoir ribs, 5 feet on centers, with a 4 inch lagging. It is believed that the yellow pine will last about 12 years before requiring renewal and at the end of that period it can be renewed or replaced with masonry.

Two classes of concrete "A" and "B" have been designated in the masonry work. Class "A" concrete, in the niches of the roof or in the side walls where the thickness does not exceed 26 inches, to be one part cement, two parts sand and four parts broken stone.

Class "B" concrete, in the side walls or tunnel arches, where the backing is rock in place, one part cement, three parts sand and five parts broken stone.

The shafts sunk were 10 by 20 feet neat size, No. 1, having a depth of 104 feet and No. 2, 180 feet, and were placed to one side in order that the shaft rigging, etc., would not be in the way of the actual tunnel. And then to, as a safeguard against accidents to laborers from the dropping of tools and excavated material into the main line of the tunnel, while being hoisted in the shaft. For drilling, the typical plan was as shown in Fig. No. 3, with the eighteen holes fired in the order indicated. From two to six additional holes were often found necessary. The cut holes fired first were the longest, being 8 to 9 feet in length. Widening holes were from 6 to 8 feet long and the round was supported to make an advance of from 4 to 6 feet. With two 3¼ inch machines, the time required to drill the holes was generally 7 hours. The total round drilled averaged about 140 lineal feet. For location of the holes note Fig. 3.

The explosive was 40 to 50 per cent dynamite, mainly the latter, the cost per cubic yard for explosives, caps, wires, etc., for all the excavation was equivalent to the cost of 3½ lbs. of 40 per cent dynamite.

The double track approaching the tunnel has been gauntleted through the tunnel, this with the third rail for contract, gives six rails in a single track tunnel. The track rails proper are 90 pounds per yard Am. Soc. C. E. section and laid with tie plates, the third rail being of the same section, but of only 75 pound weight per yard.

Electricity has been used in lighting the tunnel 16 c. p. incandescent lamps being placed approximately 40 feet apart. The lamps are arranged in groups of six 110-volt lamps per group, all lamps of each group being in series between the third and track rails proper and are located as high as possible on one side of the tunnel walls. Every sixth lamp is connected to the rail circuit with a No. 4 Brown and Sharp bare copper wire, which is securely fastened to the nearest tie and to the side wall of the tunnel. There is one feeder wire of the same po-

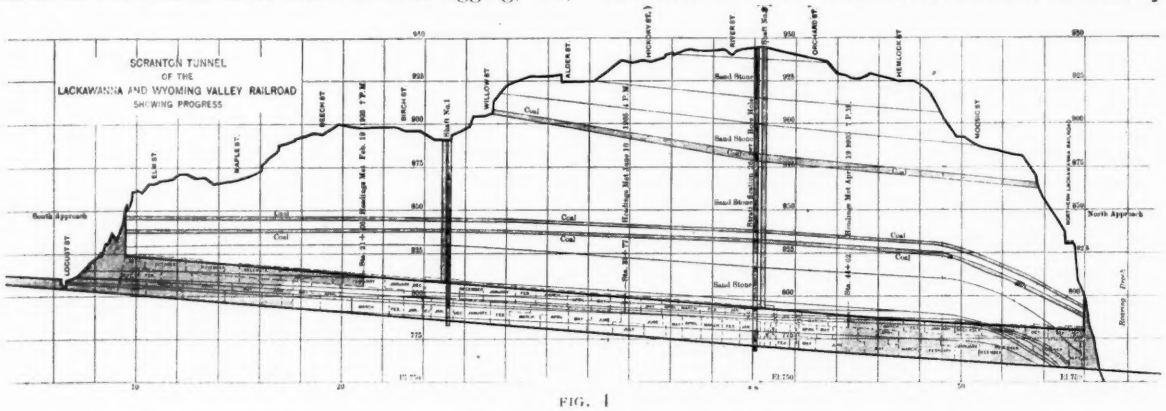


FIG. 1

larity as the third rail, running from end to end of the tunnel, to which each group of lights is tapped at every sixth lamp. The connection from the last lamp of each group is run directly to the track. A 500 volt, 3 ampere porcelain open-fuse cut-out of D. & W. make is placed in each tap between the feeder and the first lamp. This affords protection to each individual circuit, so that an accident which would cause a short circuit of any one of

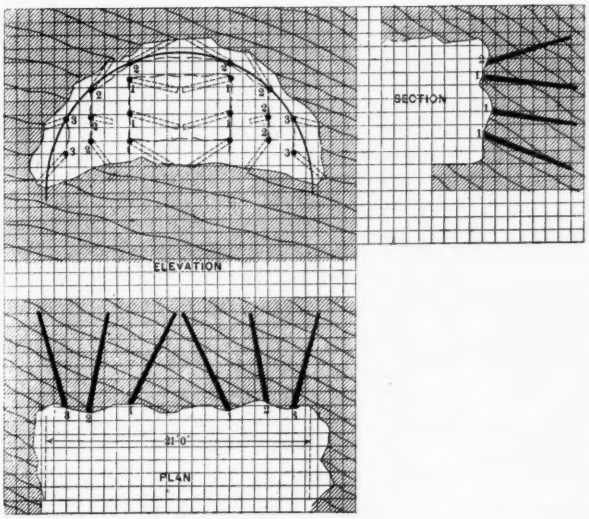


FIG. 3

the independent groups would not throw the entire installation out of service. The cost of installation was about $8 per lamp.

The electric train staff system of block signaling has been installed for the prevention of collisions on this piece of single track and hence trains are passed through with perfect safety.

Contract prices for the tunnel proper were as follows:

Shaft excavation	$ 7.00 per cu. yd.
Tunnel excavation	3.35 per cu. yd.
Backfilling over timber and behind masonry	1.50 per cu. yd.
Overhaul, 100 ft. in excess of 1,000 ft...	0.01 per cu. yd.
Class "A" concrete in forms	9.00 per cu. yd.
Class "B" concrete in forms	8.60 per cu. yd.
Third-class masonry	6.50 per cu. yd.
Long-leaf yellow pine	45.00 pr M B M

The average cost of the tunnel proper for excavation and lining including the shafts was $90 per linear foot.

The main controlling feature of the entire work was time Fig. 4 illustrating the progress made for each month. As previously mentioned, the limit as to completion was 16 months. With a large penalty and bonus per day clause the contract was let on June 1, 1904, the work being completed for laying track on July 18, 1905.

Concrete Construction on Railways

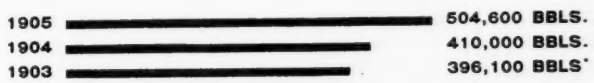
THE extensive use of concrete in railway construction is a subject that carries no surprises for those acquainted with its rapid climb to the front rank as a building material—a rise fully as meteoric as that of steel for similar purposes, and, like steel, revolutionizing many methods existing before. The reason for universal adoption of concrete in construction is not so much one of less cost as it is of facility in being molded to fit any order and condition of construction heretofore erected in stone, wood or metal, and when this vital consideration is coupled with a durability that is practically unsurpassed by any other material, there is seen to be no occasion to marvel at its rapidly increasing use in railway engineering, where bridges, viaducts, culverts, retaining walls, tunnels, foundations, roofing, signal towers and buildings furnish a few of the openings that have made its growth what it is on railways.

In the Railway Age of March 9, there is some interesting data on the increasing development of the cement business on railways and also the interest evinced by industrial users, which are given herewith entire, as most valuable points on the cement situation.

"The action of the Santa Fe in awarding contracts for the erection of 21 concrete stations along the line of the Eastern Railway of New Mexico, and the adoption of a concrete structure for the standard depot building for that road, is significant of the increasing use of cement, not alone by the railroads, but by building interests in general.

"The growth outside of the railway field is typified in the National Association of Cement Users, an organization of ostensibly broad purpose, but at present dominated by the concrete building block interests, which at its first convention had an attendance of 500, at its second annual convention boasted an assembly of 900, and for whose third meeting, to be held in January, 1907, accommodations for nearly 2,000 will probably be required.

"The increase in the use of cement by railroads has been indicated in the large number of concrete piers, abutments and retaining walls, concrete arches and culverts and concrete shop buildings which have been built of late. A fair idea of its increase may be had from the diagram herewith, which is based upon figures from five roads, representing 32,523 miles of main line.



"The roads selected represent an average expenditure for extensions and betterments, and although all are trunk lines, it may be pointed out that it is the trunk lines which represent the normal increase, the use of concrete by the smaller roads having jumped from practically nothing in the last three years following the demonstration of its qualities by the larger lines.

"To further supplement the evidence from the roads an attempt was made to obtain figures from the manufacturers of their sales to railways, but unfortunately

the data in respect to this particular class of trade are not available. One prominent manufacturer estimated that the amount of cement used by the roads, large and small, during the past year would average 50 per cent more in 1905 than in 1903. This estimate is fairly well borne out by the above figures. That the rate of increase for 1905 is not abnormal is indicated by an official statement from one road, which estimated the consumption of cement in 1906 at double that of 1905, and by advice from other roads that their purchases of cement would be larger than in any preceding year."

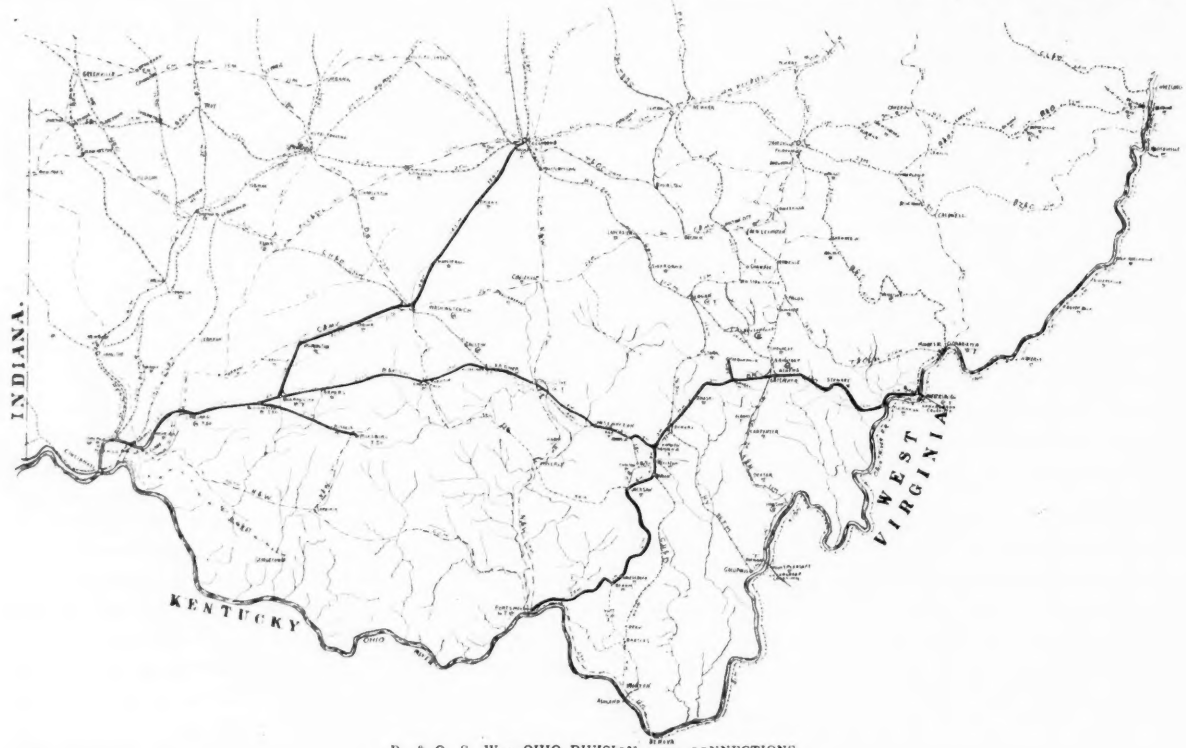
Detour Schemes

THE days of "hit or miss" railroading have passed, the tendency of the present time being to bring all affairs to a system permitting of almost instant reference. In case of wrecks, a prearranged method of getting around or detouring becomes especially valuable, saving many minutes.

This detour scheme naturally is planned by the engineer or roadmaster in charge of maintenance, generally in the way of a map showing the connections at different points, with a sufficient length of the foreign road or roads. Accompanying the map is the scheme arranged in tabular form for instant reference. For this table, the road will of course be divided into districts having a foreign road connection at the ends and contains, among other things, the name of the foreign road and the superintendent, the number of miles necessary to detour the district, and whether the heavier engines may be allowed on that particular piece of foreign road, due to weak bridges, trestles, etc. The maximum grade is also noted, the location of coaling and water stations, and whether the train can be headed in or will have to be backed up.

In detour work the best chances are offered of course in the eastern and central states, due to the greater proportion of railroads to the square mile, than found in the western states.

By a glance at the accompanying map of Southern Ohio, which shows the Ohio division of the Baltimore & Ohio Southwestern, the points mentioned above are readily noted. For instance, on the main line from Cincinnati to Parkersburg, some of the principal connections with foreign roads occur at Loveland, Chillicothe, Hamden, Grosvenor, Dundas, and Athens. At Grosvenor the foreign connection is with the Kanawha & Michigan. In case the line is blocked between Dundas and Grosvenor, the detour is made over that road from Grosvenor to Logan and then Logan to Dundas, giving a total mileage of 54.8 miles. On this line coal and water can be obtained at Nelsonville and Logan with an additional water station at Starr. The maximum grade opposing in the west bound direction is 71 feet to the mile with the maximum weight of engine allowable, 65 tons. A "Y" is located at Logan so that trains on this detour are permitted to run in the proper direction. The Superintendent in charge of this division is found to be at Columbus.



B. & O. S. W.—OHIO DIVISION AND CONNECTIONS

With the line blocked between Hamden and Dundas, the branch running from Hamden to Portsmouth is used to Wellston, when detouring trains are eastbound, and from Wellston to Dundas over the H. V. again. Coal and water can be taken at Wellston before leaving

the home road. The grade is light, the maximum weight of engine allowable being as before 65 tons. Trains detouring either can be headed in the right direction by the use of the "Y's" at Hamden and Wellston. This piece of track from Wellston to Dundas is also under the Superintendent located at Columbus.

Prints of both the map and tabulated scheme are generally placed on file in the Superintendent's or the Chief Dispatcher's office, or both if they are separated to any extent. As soon as word is received of the line being blocked and to such an extent that "detouring" is necessary, the Superintendent in charge of the foreign division is requested for permission to use his track between such and such a place. Trains are then held at the nearest junction until permission is received. Upon receiving it, the train is under control of the foreign road and is subject to their rules until it finally returns to the home road. The chances of making a rapid detour are naturally much better at the larger junction points where routes may be planned on two or more different roads.

Simultaneous Telegraphy and Telephony

J. C. KELSEY.

BALANCE, or equilibrium, is a supreme law of the universe. The earth is so balanced that it maintains a fixed relation to the sun. The moon is so balanced that it also maintains a fixed relation to the earth. When Newton's historic apple fell to the ground, it was seeking a balance in respect to the earth, being no longer sustained by the tree. The bridge is designed to balance the heaviest load. The locomotive driving apparatus is balanced, not only to secure smooth running, but to prevent the destruction of the track. The armature of the dynamo is balanced, not only for smooth running, but for prevention of destructive strains. Even nations preserve a balance of power, to keep from fighting.

Once balance destroyed, trouble ensues. Nations fight, tracks are ruined, bridges sink under loads, locomotives cannot make schedules, and the dynamo becomes inoperative. Ignoring the law of balance invites inevitable disaster.

The essential feature of a successful telephone operation is balance. Owing to the marvelous sensitiveness of the telephone receiver, conditions which would be as mole-hills in some usage, behave as mountains in telephone service. Telephone service may be said to be surrounded by many enemies. Every electric circuit tends to induce in every neighboring electric circuit, electric currents as near like its own as is possible. Each telegraph, trolley, power and light circuit induces currents in the telephone circuit, which, however weak from a power standpoint, are strong enough to make a receiver interpret loud noises.

The only way to prevent these currents induced in the telephone circuits from making noise in the telephone receiver is to prevent them from passing through the receiver. This is accomplished by a balance. A balance is a condition in which one side of a circuit must be exactly the same as the other. From this, it shows that a grounded line is impossible of balance. The earth is unlike the wire in size, resistance, and carrying capacity. Hence, telephone service calls for two wires of equal size, resistance, and carrying capacity. Fig. 3 reveals a metallic telephone circuit, paralleled by a trolley wire. In the middle of the circuit is shown a transposition, which is a refinement of balance. If the wires are not crossed over, side x would induce the greatest current, hence, in coming to equilibrium, some current would pass from side x to side y through the telephones, marked T. The transposition puts each wire equidistant from the trolley, hence each wire has induced about the same amount of current, and neutralization takes place in the wires, without passing through the telephones.

Figure 3 shows what is called a simplex circuit, the simplest combination of telephone and telegraph. Repeating coils are placed at each end of the telephone circuit, and at the middle point of the line side of the

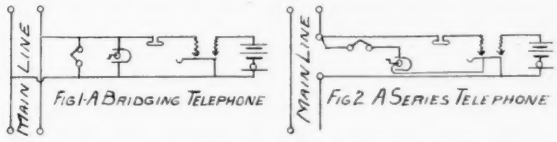


FIG 1. A BRIDGING TELEPHONE — FIG 2. A SERIES TELEPHONE

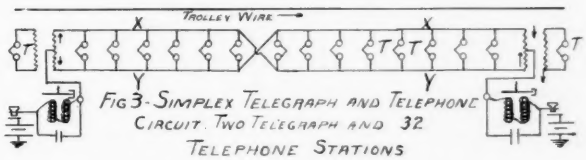


FIG 3. SIMPLEX TELEGRAPH AND TELEPHONE CIRCUIT. TWO TELEGRAPH AND 32 TELEPHONE STATIONS

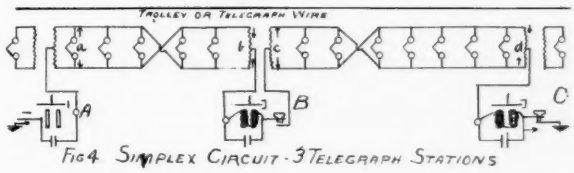


FIG 4. SIMPLEX CIRCUIT - 3 TELEGRAPH STATIONS

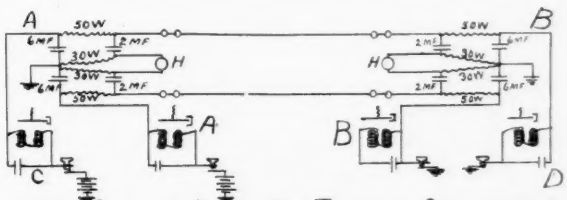


FIG 5. STANDARD CIRCUIT - TWO TELEGRAPH CIRCUITS AND TERMINAL TELEPHONES

coils is tapped the telegraph circuit. If these telegraph taps were not in the middle points of the coils, the induced current from the trolley would not be neutralized in the wires. If instrument A were tapped at point c, instead of a, the balance would be destroyed, and currents would pass to ground through the telephones to get to the point c.

If the telegraph circuit were connected at ponit c, the ticking would be heard in the telephones, because more

current would go through one quarter of repeater than the other. Hence, the telegraph currents would be induced in the telephone circuit. Tapped at points a and b, the telegraph currents are equal, and in opposite directions, hence no current is induced in the other half of the repeater.

In figure 4 is shown a simplex system with three telegraph stations. The repeating coils are placed at A, B and C. The middle points are tapped at a, b, c and d. There could be made four or five telegraph stations, which would add two repeating coils in the telephone circuit.

The usual difficulty with this simplex method is ringing. Repeating coils are either designed for talking or ringing through. One has to be sacrificed for the other. In this work, a combination is made, which admits of five coils being used, allowing good transmission and ringing.

In the March issue of the Railway Master Mechanic, it was pointed out that the Northern Pacific people could not successfully operate their quadruplex telegraph service with iron in the coils, and simply tapped the middle point of a simple non-inductive bridge. Owing to the complex nature of quadruplex currents, it is impossible for currents in tandem wound coils to completely neutralize, even though they pass through the coil balanced, and in opposite directions. Some of the energy is given back to the circuit. This means self-induction. This means a time constant. And a time constant too great for fast quad work. In simple telegraph work, there is a slowing process, although not enough to harm.

It has been stated that the requirements of balance prevent current from passing through the telephones on the circuit. This leads to the question as to what kind telephones to use. In figure 1 is shown a bridging telephone, which is put directly across the circuit. This telephone should have a 1600 ohm ringer, and a five bar generator. This will give service for thirty telephones, and five telegraph stations.

Figure 2 shows a series of telephone, in which the main line is opened and a telephone put in. The eighty ohm ringer coils would seriously retard the speed of the telegraph, and when used for talking, the telegraph currents would pass directly through the receiver and induction coil secondary. Such a usage would not be tolerated. The use of series instruments on lines paralleling telegraph, trolley and lighting circuits invites great noise.

It will be noted in figures 3 and 4 that condensers have been placed about the telegraph relays. This usually relieves the telephone circuit of a slight interference.

As a general proposition, it is much easier to convert a good metallic telephone line into simultaneous telegraph work than it is to take an old pair of telegraph circuits, and make them do simultaneous telephone work. It is cheapest on the long run to build a new telephone circuit, and reduce it to telegraph. If there are two through telegraph wires, they could be converted into simultaneous service by a combination shown in figure 5. This is known as the standard simultaneous set. It permits of two separate telegraph circuits, and one telephone circuit.

At station A, line X would have a fifty ohm coil inserted, also one at station B. Telegraph instruments C and D would be slowed down slightly by this addition of 100 ohms. The line Y would also be treated with two fifty ohm coils, through which telegraph instruments A and B would have to operate.

At station A, on the telegraph instrument side are two six microfarad condensers in series, and at a point between them is placed a ground. This looks like a local circuit between telegraph stations A and B. On the line side of the fifty ohm coils are placed two two-microfarad condensers, in series with a howler, and telephone, marked H. From ground, two thirty ohm coils are connected, in shunt about the howler H. At station B, this is also done.

To ring with the ordinary twenty cycle ringing current from A to B with a sixty ohm bridge, and through condensers, thence over a long line, through two more condensers, and a device, shunted by two thirty ohm coils, would seem impossible. It is. Therefore, higher frequency currents are used. Howlers are used instead of ringers, or drops. When A wants B, a high frequency current is impressed on the line, which finds sufficient impedance in those thirty ohm coils to ignore them, and thereby energize the howler.

The telephone companies have a vast amount of telegraph work done over their commercial telephone lines. With a revenue of $15 or more per mile annually, one can see that fixed charges are nicely taken care of. It stands to reason that simultaneous work is the work of the future. Why should the telephone and telegraph companies cover the country with separate leads, when one will do? It is the old story of doubt concerning the utility of the telephone. The telephone is the one way of communication which bids fair to be permanent. All other methods are threatened with extinction, unless they combine with the telephone, which, before we die, will be in every home in the land. Telephones are being manufactured, and placed at the rate of 150,000 per month. And it looks as if there were three or four more years of such business.

When the railroads adopt and trust the telephone, its final victory will be won.

Reinforced Concrete Round House for the Wabash at Landers

THE Wabash railroad has pust completed a 20 stall roundhouse, drawings of which are shown herewith. The side and rear walls and pit walls of the building are of reinforced concrete and the partition walls of plain concrete, the roof being covered with the Eastern Roofing Company's gravel roof. All walls, both building and pit, rest on piles 18 feet long except the piles in the rear building wall on the pit center lines the piles in the feet long. The roof supporting columns each rest on a 20 foot pile. The wall footings are 18 inches deep and 3 feet wide. For 4 feet 6 inches above or up to the rail

level the thickness is 18 inches reducing to 12 inches for the remainder of the height except the cornice, where there is an increase to 15 inches.

The drawings show the arrangement of reinforcing steel rods which are either the corrugated or the Ranson Twist rod. In the footings there are 3 parallel rods, 9 inches on centers laid directly on top of the piles. Short bars 2 feet 6 inches long are laid transversely to these, the space varying from 18 inches to 24 inches. In the wall all horizontal rods are spaced 18 inches on centers and the vertical rods vary the same as the transverse foundation rods.

The piles supporting the pit walls are staggered and are 4 feet, 5⅛ inches on centers. The footing and wall dimensions are the same as for the corresponding courses in the building walls. The pit floor is paving brick laid on edge on a sand bed and grouted. The rails rest on cast iron plates bedded in the top of the wall and spaced 5 feet on centers.

By referring to the drawing of the door fastener you will see that it consists of an 8 foot length of 63 pound rail bedded in concrete block 18 inches square and 6 feet high. The top of the block is flush with the ground, the rail projecting 3 feet 6 inches above. The door is fastened to the ladder by hooks.

One section of the house is at present used for a power house, it having three boilers, one engine and two air compressors as well as the necessary pumps for washing boilers. The water is supplied from a well back of the main building, compressed air being used to elevate it to the surface.

The heating is by direct steam radiation, pipes being placed in the pits on the sides. The original intention was to have the top of the pipes covered with projections on the pit but this was later abandoned and pipes placed far enough out so as to have nothing above them.

The lighting of the house is by means of gasoline lamps which are hung between the pits. The smoking gases are carried out by means of the Dickinson adjustable smoke jack, while the highest points of the roof are provided with a ventilator to let out any steam that may escape the jacks. The concrete work was done by W. P. Carmichael of Williamsport, Indiana, the whole work being directly in charge of Mr. A. C. Butterworth, Division Engineer of the Wabash.

The location of the building is very convenient to the

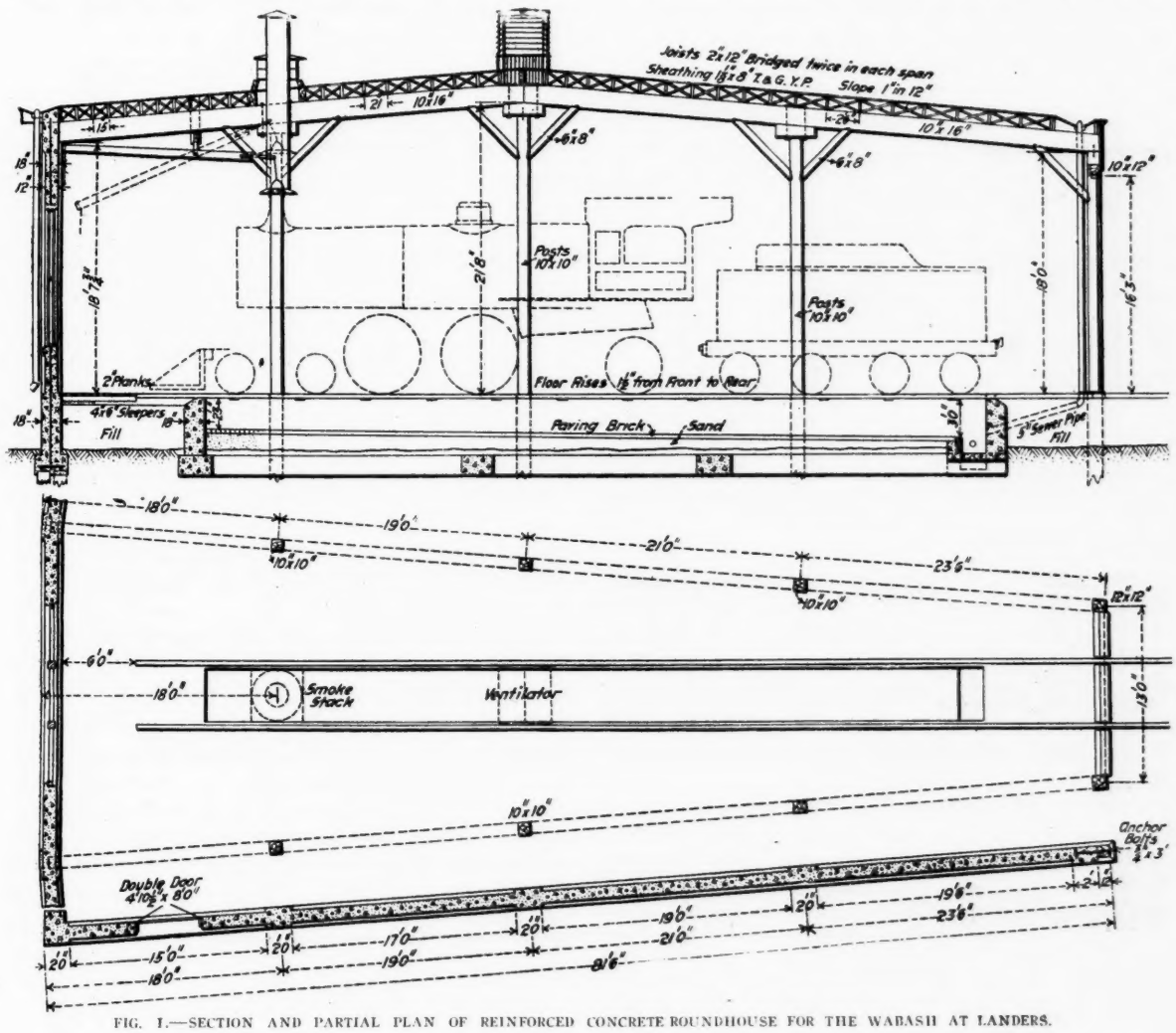


FIG. 1.—SECTION AND PARTIAL PLAN OF REINFORCED CONCRETE ROUNDHOUSE FOR THE WABASH AT LANDERS.

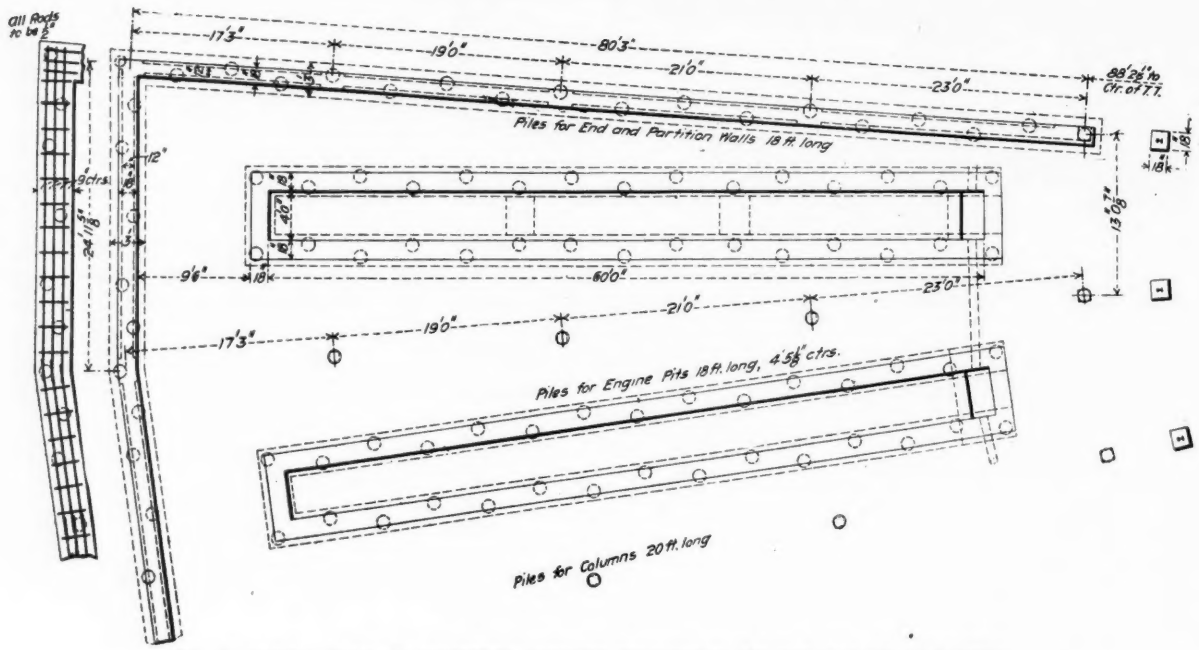


FIG. 2.—PARTIAL PLAN OF REINFORCED CONCRETE ROUNDHOUSE FOR THE WABASH AT LANDERS.

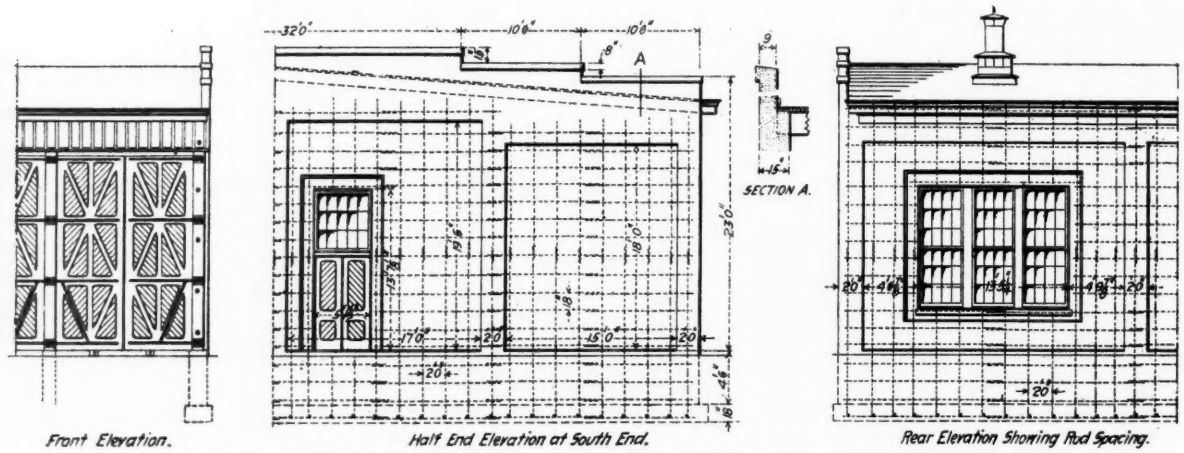


FIG. 3.—DETAILS OF REINFORCED CONCRETE ROUNDHOUSE FOR THE WABASH AT LANDERS.

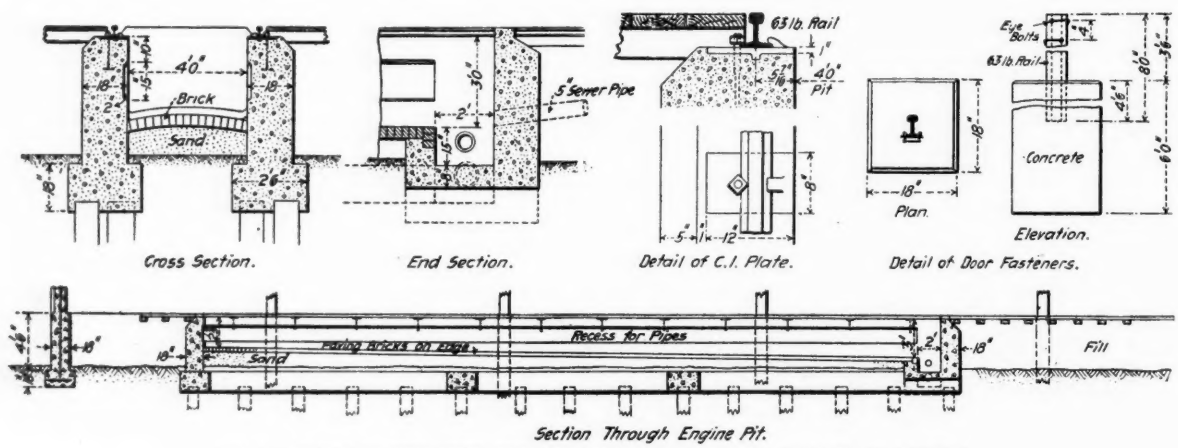


FIG. 4.—DETAILS OF REINFORCED CONCRETE ROUNDHOUSE FOR THE WABASH AT LANDERS.

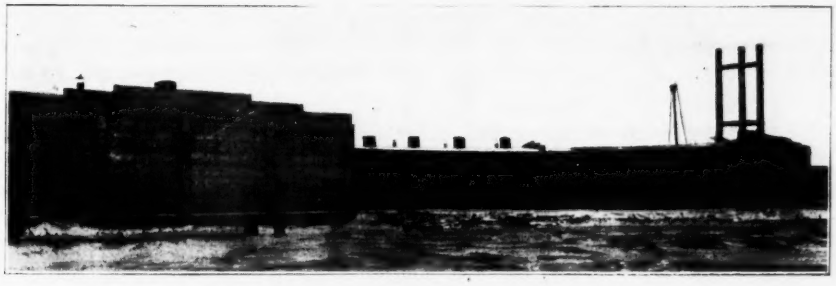


FIG. 5.—REINFORCED CONCRETE ROUNDHOUSE FOR THE WABASH AT LANDERS.

main switching yard, which is directly west of the round house. This yard handles all the freight from Chicago with the exception of perishable goods. It is also conveniently located to the car repair yard which is north of the freight yard.

We are indebted to Mr. A. O. Cunningham, Chief Engineer, for the drawings, etc.

Personals

Mr. R. T. Guppy has been appointed principal assistant engineer of the Union Pacific, with office at Omaha, Neb.

Mr. C. H. Ellison has resigned as resident engineer of the Southern Pacific at Los Angeles, Cal.

Mr. George J. Bishop has resigned as master of bridges of the Grand Trunk at Durand, Mich.

Mr. F. W. Terhune has been appointed assistant engineer of the Baltimore & Ohio.

Mr. James L. Armstrong has been appointed chief engineer of the Cairo & Thebes, with headquarters at Cairo, Ill.

Mr. J. C. Young, heretofore general signal inspector of the Southern Pacific, has been appointed signal engineer of the Union Pacific, with office at Omaha, Neb.

The headquarters of Mr. R. J. Arey, resident engineer of the Atchison, Topeka & Santa Fe Coast Lines, have been removed from Williams, Ariz., to San Bernardino, Cal.

Mr. L. C. Ryan, heretofore roadmaster of the Chicago & Northwestern at Sterling, Ill., has been transferred to Baraboo, Wis., in a similar capacity.

Charles M. Bennett, inspector of maintenance of way of the Pennsylvania Lines, Southwest System, at Columbus, O., died at Urbana, O., on April 11.

Mr. G. M. Campbell has resigned as electrical engineer of the Pittsburg & Lake Erie to accept a position with the Western Electric Company of Chicago.

The office of Mr. R. S. Charles, division engineer of the Illinois division of the Chicago & Eastern Illinois, has been removed from Villa Grove to Salem, Ill.

Mr. A. C. Carr has been appointed roadmaster of the Louisville & Nashville at Middlesborough, Ky., in place of Mr. W. G. Arn, resigned.

Mr. E. L. Cruger has resigned as assistant engineer of the Louisville & Nashville to become chief clerk to the chief engineer of the Chicago & Alton, with office at Chicago.

Mr. C. H. Blackman, assistant engineer of the Louisville & Nashville at Pensacola, Fla., has been transferred to the office of the chief engineer at Louisville, Ky.

Mr. J. O. Ely has been appointed assistant engineer of the Louisville & Nashville at Knoxville, Tenn., in place of Mr. E. L. Cruger, resigned.

Mr. Lon Palmer has been appointed roadmaster and supervisor of bridges and buildings of the Trinity & Brazos Valley, with office at Cleburne, Tex.

Mr. M. A. Hansen, chief engineer of the Beaumont Sour Lake & Western, has been appointed assistant engineer of the St. Louis & San Francisco at St. Louis, Mo.

Mr. F. H. Watts has been appointed engineer of maintenance of way of the Vandalia at Logansport, Ind., in place of Mr. E. L. Shaneberger, resigned.

Mr. A. Q. Campbell has been appointed engineer of track and structures of the Atlantic & Birmingham Construction Company, with office at Oglethorpe, Ga.

Mr. P. F. Connelly, heretofore roadmaster of the Great Northern at Willmar, Minn., has been transferred to Sioux City, Ia., in a similar capacity.

Mr. E. R. Clarke has been appointed assistant engineer of the Central New England at Hartford, Conn., in place of Mr. H. O. Buck, resigned.

Mr. C. E. Laas, heretofore superintendent of the Kansas City division of the Chicago, Milwaukee & St. Paul, has been appointed engineer of maintenace of way, with headquarters at Chicago.

Mr. S. C. Brown has resigned as division engineer of the New York division of the Erie at Jersey City, N. J., to become associated with A. O. Brown & Co., bankers and brokers of New York.

Mr. A. E. Hess has resigned as principal assistant engineer on surveys for the Pensacola, Alabama & Western at Selma, Ala., to become chief engineer of the Augusta Construction Company of Augusta, Ga.

The office of Mr. Alex. Bonnyman, chief engineer of the Atlantic & Birmingham Railway and the Atlantic & Birmingham Construction Company, has been removed from Oglethorpe, Ga., to 24 East Alabama street, Atlanta, Ga.

Mr. James M. Reid, chief engineer of construction of the National Lines of Mexico, has been appointed chief engineer, with headquarters at Mexico, Mex., to succeed Mr. R. T. McDonald, resigned.

Mr. A. De Haas, heretofore connected with the Atlantic & Birmingham Construction Company, has been appointed engineer of construction of the Ferrocarril Atlantico, with headquarters at Monkey Point, Nicaragua.

Mr. Edward J. Beard has resigned as principal assistant engineer of the Chicago, Rock Island & Pacific to accept a position with J. G. White & Co., of New York, in charge of railway construction in the Philippine Islands.

Mr. F. P. Gutelius, engineer of maintenance of way of the Canadian Pacific, has been appointed assistant chief engineer of that road, with office at Montreal, Que., and will have immediate charge of engineering and maintenance on the eastern lines.

Mr. J. T. Taffany, division engineer of the Jefferson and Wyoming divisions of the Erie, has been transferred to Jersey City, N. J., as division engineer of the New York division, succeeding Mr. S. C. Brown, resigned.

Mr. F. O. Draper, supervisor of bridges and buildings of the Illinois Central at Freeport, Ill., has been appointed superintendent of bridges, with office at Chicago, in place of Mr. A. W. Bellows.

Mr. A. D. Page, heretofore bridge engineer of the Chicago, Rock Island & Pacific at Chicago, has been appointed principal assistant engineer of that road, with headquarters at Chicago, succeeding Mr. Edward J. Beard, resigned.

Mr. A. M. Mullinix, heretofore foreman of bridges and buildings of the Fort Worth & Denver City, has been appointed assistant superintendent of bridges and buildings and water service, with office at Fort Worth, Tex.

Mr. W. J. Towne, division engineer of the Chicago & Northwestern at Chicago, has been promoted to a position in the chief engineer's office, in charge of permanent work and other special work which may be assigned to him.

Mr. B. B. Gordon, engineer of construction of the Colorado Southern, New Orleans & Pacific, has been appointed chief engineer of the Beaumont Sour Lake & Western also, with headquarters at Beaumont, Tex., to succeed Mr. M. A. Hansen, resigned.

Mr. John C. Brackenridge, president of the Rossiter-MacGovern Co., and formerly general manager and chief engineer of the Brooklyn Rapid Transit Co., has been appointed consulting engineer of the New York Central & Hudson River, with headquarters at New York. His duties will be in connection with the proposed change of motive power from steam to electricity in the electric zone.

Mr. Henry W. Parkhurst, formerly engineer of construction and later engineer of bridges and buildings of the Illinois Central, died in Chicago on April 7 from injuries received on February 10, when he was struck by a locomotive on the Illinois Central, while crossing the tracks at Windsor Park.

Mr. W. M. Duane, heretofore superintendent of construction of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed chief engineer of that road, with headquarters at Cincinnati, O., effective on April 9, to succeed Mr. George W. Kittredge, resigned.

Mr. William H. Finley, who was formerly principal assistant engineer of the Chicago & Northwestern and who resigned to engage in the contracting business, has been appointed assistant chief engineer of that road, with headquarters at Chicago, to succeed Mr. F. H. Bainbridge, assigned to other duties.

Mr. David H. Wilson, Jr., who has heretofore had charge of electrical work for the American Locomotive Company at Montreal, has been appointed electrical engineer of the Erie, with headquarters at New York City, effective on March 15. Mr. Wilson will have charge of power plants and electrical installations in power plants, shops, etc.

Mr. George S. Brigham, heretofore roadmaster of the Chicago & Northwestern at Mankato, Minn., in charge of the line from Mankato to Tracy, has resigned to accept a position in the maintenance of way department of the Erie Railroad, reporting to Mr. James Burke, engineer maintenance of way at Jersey City, N. J. Mr. Brigham is a Yale graduate in civil engineering, class of 1901.

Mr. A. L. Hertzberg, division engineer of the Ontario division of the Canadian Pacific, has been appointed engineer of maintenance of way, with office at Montreal, Que., to succeed Mr. F. P. Gutelius, promoted. Mr. J. M. R. Fairbairn, division engineer of the Eastern Division, has been appointed division engineer of the Ontario division at Toronto, Ont., in place of Mr. Hertzberg. Mr. J. H. Barber, division engineer of the Atlantic division at Saint John, N. B., has been appointed to succeed Mr. Fairburn as division engineer at Montreal.

Mr. E. B. Taylor, Jr., has been appointed assistant engineer of the Eastern division of the Pennsylvania Lines, Northwest system, at Pittsburg, Pa., in place of Mr. F. H. Watts, transferred. Mr. W. M. Murdoch has been appointed assistant engineer of the Cincinnati division, Southwest system, at Cincinnati, O., succeeding Mr. Taylor. Mr. G. R. Barry has been appointed to succeed Mr. Murdoch as assistant engineer of the Indianapolis division, Southwest system, at Columbus, O. Mr. R. C. Miller has been appointed assistant engineer of the Marietta division, Northwest system, at Cambridge, O., in place of Mr. Barry.

Mr. George W. W. Kittredge, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway, has been appointed chief engineer of the New York Central and the West Shore roads, with headquarters in New York City. Mr. Kittredge succeeds to the position made vacant several months since by the resignation of Mr. Fernstrom. He is 50 years of age, and was graduated from the Massachusetts Institute of Technology, entering soon thereafter the employ of the Pittsburg, Cincinnati & St. Louis Railway, and later connected with the Pennsylvania lines west of Pittsburg.

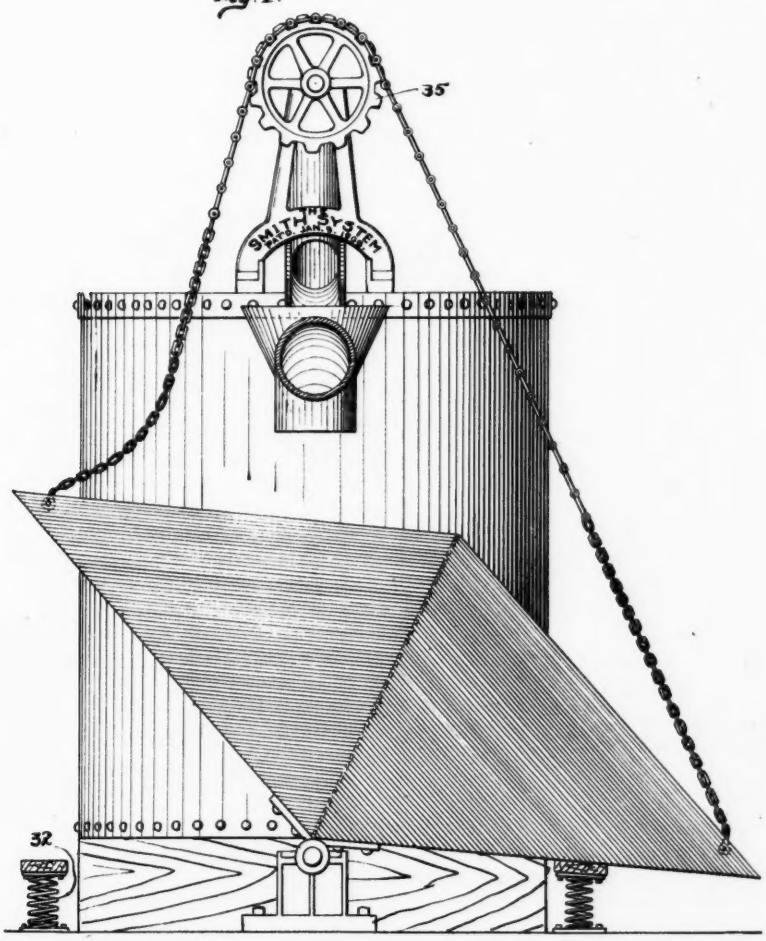
Mr. E. H. Fritch, as briefly noted in the report of the annual meeting of the American Railway Engineering and Maintenance of Way Association, published in RAILWAY ENGINEERING AND MAINTENANCE OF WAY of April, has been elected secretary of that association, to succeed his brother, L. C. Fritch, now assistant to the general manager of the Illinois Central Railroad. This involves

no change in the operation of the permanent office of the association, and is a well deserved recognition of the faithful and at times arduous work which Mr. Fritch has devoted to the association's affairs from the first. Shortly after the organization of the association in 1900, it was deemed advisable by the board of direction to open a permanent office in Chicago. Mr. L. C. Fritch, who had been elected secretary, was then in the service of the Baltimore & Ohio Southwestern and to Mr. E. H. Fritch, who as the secretary's assistant had already taken up the routine work of the office, was given charge of the office at 1562 Monadnock block, Chicago, which has remained headquarters up to the present time. The secretaryship of a lively association of about 600 members in all parts of the world requires that the secretary's office constitute itself into a clearing house for all sorts of inquiries throughout the year, aside from the vast amount of work required in making ready for the printers fragmentary reports from sixteen standing committees, discussions thereupon and a variety of miscellaneous announcements. That these affairs have been handled to the satisfaction of the membership the recent election demonstrates. Mr. Fritch was born at Galena, Ill., and lived at Springfield, Ill., until entering the service of the Baltimore & Ohio Southwestern in the engineering department. A familiarity with the printing business acquired in his earlier life has been of marked advantage to the association in the appearance of its numerous publications.

Operation of Water Softening Machine

The operation of the Smith Water Softening machine may be described as follows: After having determined by analysis or otherwise the character of the raw water which is to be treated the kind of chemical to be used for purifying the same may be ascertained. Also, the exact proportion of water and chemical may be decided upon. The required chimical is then placed within the tank 10. The raw water is fed to the tilting vessel through the pipe 34. Assuming the tilting vessel to be in the position shown in Fig. 1, the left-hand compartment is filled with water until the center of gravity of the vessel is shifted by the accumulated water to the left of the center of the shaft 30. This causes the vessel 29 to tilt or oscillate toward the left, the lower wall of the left-hand compartment moving downward until eventually it is stopped by the spring-stop 32. During this oscillation toward the left the water is discharged from the left-hand compartment, and at the same time the right-hand compartment is brought below the discharge-pipe 34, so that the water now flows into the right-hand compartment. The downward movement of the water in the left-hand compartment during the tilting of the vessel toward the left is a source of power which by way of the chain 36 causes a counter-clock-wise rotation of the sprocket-wheel 35 and the rock-shaft 15 attached thereto. It will be noted that with the tilting vessel in the

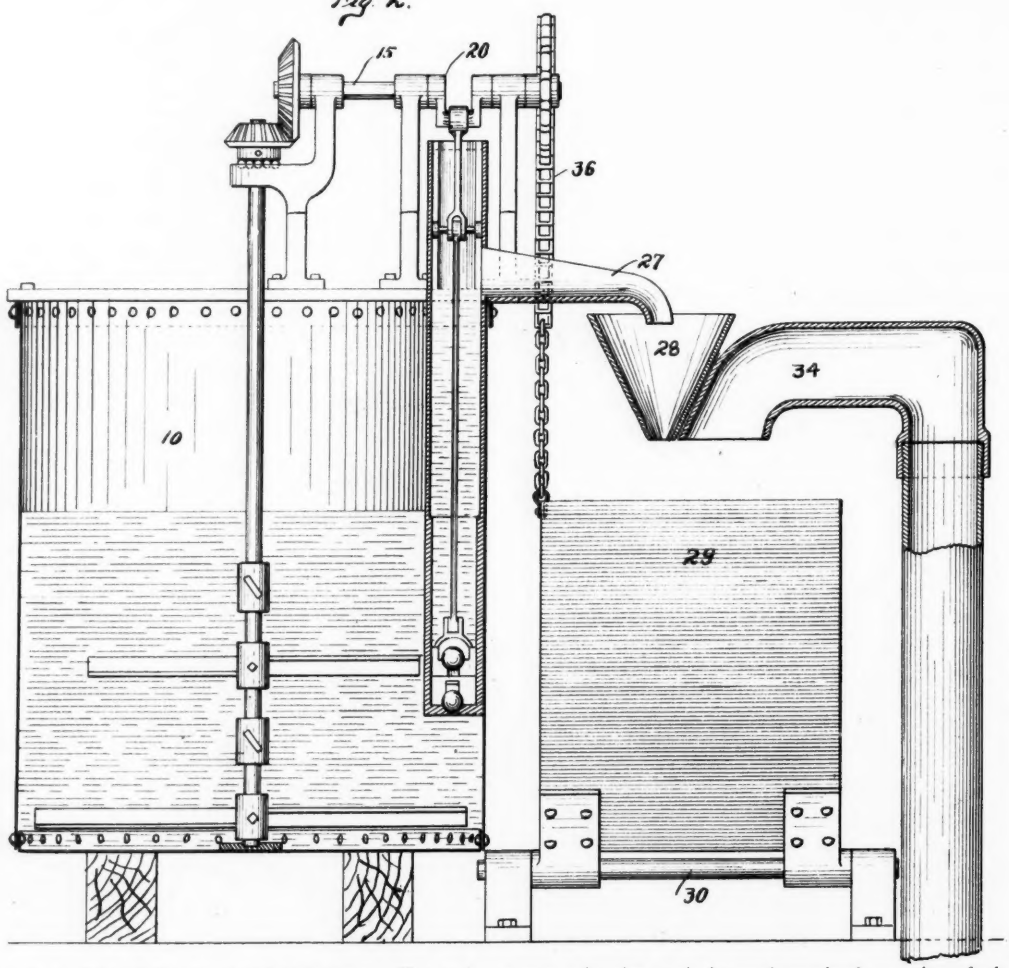
Fig. 1.



right-hand position, as shown in Fig. 1, the pump-rod and piston are at the lowest point of their stroke. As the vessel tilts toward the left, causing the rotation of the sprocket-wheel, the crank 20 compasses one revolution, complete or partial as required, causing first the pump-rod and piston to be raised through their full stroke, thus discharging a certain amount of chemical by way of spout 27 and the funnel 28 into the tilting vessel 29. The amount of chemical discharged for a single stroke of the pump is, of course, determined by the length of the stroke and the size of the pump-cylinder. After having reached the highest point in its stroke the pump-rod returns to its lowest position, as shown in Fig. 2, being assisted in its downward movement by the weight of the pump-rod and piston. The sudden downward movement of the pump-rod is checked and prevented, however, by the stirring mechanism, which is geared to the same shaft as that upon which the crank 20 is carried, thus preventing wear and tear upon the parts of the machine, especially the mechanism directly associated with the pump. As soon as the tilting vessel has shifted to the left the water is discharged from the raw-water pipe 34 into the right-hand compartment of the tilting vessel, as is also the major portion of the chemical discharged by the pump during the movement of the tilting vessel toward the left. As the right-hand compartment is filled the center of gravity of the tilting vessel is shifted toward the right until the vessel is caused to tilt toward the right, discharging again an amount of water precisely equal to that previously discharged from the left-hand compartment and causing also a clock-wise rotation of the sprocket-wheel 35 and the rock-shaft attached thereto. Thus with the movement of the tilting vessel toward the right the pump-rod is carried once more through a full upward and downward stroke, thus discharging again an amount of chemical exactly equal to that which was discharged during the movement of the tilting vessel toward the left. The major portion of the chemical discharged during this stroke is into the left-hand compartment of the tilting vessel, which is again filled by the constantly flowing water from the discharge-pipe 34, whereupon the cycle of operations already described is indefinitely repeated.

It will be noted in connection with this device that there is but a single pump discharging first into one compartment of the tilting vessel and then into the other, the amount of chemical discharged being exactly the same for each stroke of the pump, whereby a nicely predetermined quantity of chemical is mixed with a given quantity of raw water in one compartment of the vessel and then precisely the same amount of chemical is mixed with the same proportion of raw water in the other compartments of the tilting vessel. This exact and uniform mixture of water and chemicals for treating the same is of the utmost importance in securing satisfactory results in the softening or purification of water.

Fig. 2.



It will be noted also that the single pump which is used in this machine passes through two complete cycles of upward and downward strokes during each complete cycle of oscillations by the tilting vessel, and for a pump which is suitable for use in this connection the highest efficiency is secured by a comparatively frequent movement of the reciprocating parts of the pump. The pump stroke is positive because the mechanism controlling it moves always through a fixed position, whether the tilting vessel tilts to the right or to the left. The movement of the pump is also slow and its discharge gradual.

An important feature of this machine is the means for readily adjusting the amount of chemical to the amount of water delivered to each compartment of the tilting vessel by varying the length of the chains, or by shifting their points of attachment toward the center of oscillation of the tilting vessel.

The degree of revolution of the rock-shaft 15—which governs the stroke of the pump—may be decreased; but with this decrease in the degree of revolution of the rock-shaft, a precise uniformity in the quantity of chemical delivered for each oscillation of the tilting vessel is at once obtained, there being but a single measuring pump. A given revolution of the rock-shaft from corresponding initial positions will always cause the delivery of the same amount of chemical. The adjustment, therefore, of but a single pump stroke is all that is required in order that the chemical shall be supplied to a given proportion of water with absolute uniformity and regularity.

In making this adjustment it is required only that the revolution of the crank 20 shall be through the same angular distance to either side of the vertical position. This will insure the return of the pump rod and piston to the same initial position, no matter whether the tilting vessel tilts to the right or to the left.

The apparatus is simple, for the reason that the single rock-shaft provides the means for interconnection between all of the movable parts of the machine, the tilting vessel, the pump and the stirring blades all being connected mechanically with this single shaft. The machine having but few parts, can be quickly and easily assembled and dismantled when desired—an important item.

Any further information will be gladly furnished by the inventor, Mr. R. C. Smith, 929 Monadnock Block, Chicago.

Percival Re-inforced Concrete Tie

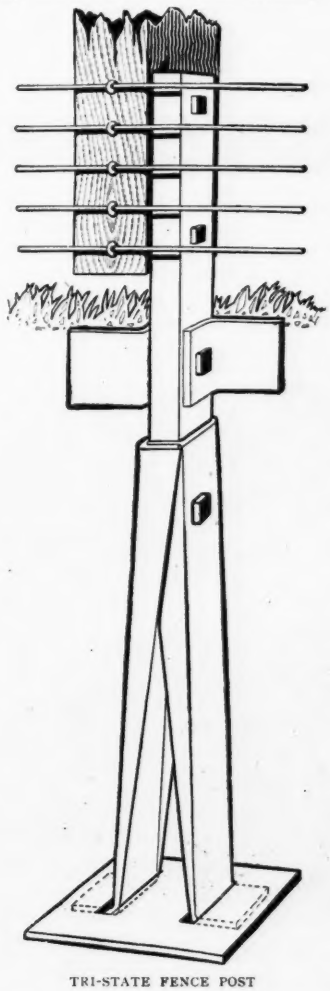
The concrete tie has come to stay. Through its durability and the firm bearing that it gives the tracks, its more general use is but a question of time. Of the many concrete ties now on the market the Percival Reinforced Concrete Tie, patented by Mr. H. E. Percival of Houston, Texas, has achieved marked success. The tie is 9 inches wide, 10 inches deep and 8 feet long, is reinforced with four corrugated steel bars each weighing six pounds. As to the general shape it embodies characteristics essential to a good bond with both ballast and tie, the ends of the base being oval for 3 feet, with an average bearing of about 5 inches, the center being cut away for 2 feet forming a perfect shape. Between the rail and tie a treated wood cushion of hard wood 1⅞ in. x 9 in. x 14 in. is used. Sockets have been cast in the tie and filled with a composition of galvanized cut wire and babbit metal so arranged as to receive a screw spike ⅞ in. x 10 in. The accompanying cut shows the ties in place on the Galveston, Houston & Henderson Ry. at Galveston, Texas, in a location receiving a very heavy and constant traffic. These ties have been in place at this point for 8 months and show no sign of fracture.

PERCIVAL RE-INFORCED CONCRETE TIE

A New Fence Post

The problem that is confronting the railroads on ties is also being driven home by the scarcity of timber for fence posts along the right of way. The importance of this subject was fully realized when the American Railway Engineering and Maintenance of Way Association appointed a committee on Signs, Fences, Crossings and Cattleguards and the committee made a report on fences.

The difficulty encountered with the ordinary wooden fence post is that it is subject to decay at the ground line besides being in constant danger of burning when the grass along the right of way is burned. These difficulties are entirely eliminated by the use of the post illustrated herewith and manufactured by the Tri-State Post & Fence Co. of St. Anne, Ill. In this construction an iron base is used to which is bolted any kind of wood for fastening the wires, etc.



TRI-STATE FENCE POST

The durability of this base can be judged when it is known that about fifteen years ago the Big Four railroad put into use about 400,000 metal posts constructed of 1-16 inch sheet metal. About 90 per cent. of these posts are in use yet and the indications are that they will be for some time to come. When it is considered that these posts lasted at least fifteen years and the post illustrated herewith is constructed of metal five times as thick it will not require much argument to demonstrate that the latter will last fully from 80 to 100 years.

With this post the wood does not touch the ground and hence

will not rot. Now supposing you have posts that are rotted off at the top of the ground, don't throw them away. All that it requires is to saw them off an inch or two above the ground, dig out the rotten ends, set the Tri-State iron bases in the holes, lag bolt or bolt the iron bases to them, fill in the dirt, tamp well, and you have posts at a less expense than new ones would cost, and at the same time will last a generation or longer.

The Kofske Improved Rail Joint Splice

The importance of the rail joint splice today is universally recognized by railroad men throughout the country. Ordinary angle bars while cheap at first cost, too often have cost many times their original value for repair, their faults are many, their advantages few and far between.

Realizing the need of a strong but a simple splice, the inventor has gone to work with these two dominating ideas. The Kofske

KOFSKE IMPROVED RAIL JOINT SPLICE

Improved Joint Splice is the result, which embodies both simplicity and strength. To do away with the customary breaking at the center, extra metal has been added, extending nearly to the top of the bar in the center and gradually dropping off toward the end. The six bolt type which is used in this splice, has been conceded to be much better than the four bolt or short joint type for proper lining, surfacing and the care of rail expansion. While the six bolt or long splice has all of these advantages it undoubtedly has been cast aside after considerable experimenting, due to the frequent breaking. This splice is guaranteed against such breaking as other types do and comparative tests are invited to prove this statement. It is also found by the use of this splice a complete freedom from the occurrence of battered rail ends. These splices can be manufactured with round or oblong holes and with or without spike slots as desired.

This splice as above described is patented by Charles H. Kofske, of Parkersburg, Iowa, and manufactured by J. H. Snow, of Indianapolis, Ind.

Modern Method of the Manufacture of Railroad Frogs

The Louisville & Nashville Railroad Company recently placed a contract for furnishing its entire supply of railway frogs for the coming year with a single concern, the Weir Frog Company, which is, without a doubt, possessed of the best equipped and up to date frog and crossing shops in the country. They are located in Norwood, Ohio, a suburb of Cincinnati, on the B. & O. S. W. and the C. L. & N. (Penn. Lines) Railways.

The erecting and main machine floor is 125 feet by 340 feet, served over its entire length by two electric cranes, one of which is used largely in loading and unloading freight cars, brought into the north end of the shop building on a C. L. & N. Ry. switching track capable of holding twelve cars, and so built that the car floors come flush with the main floor of the shop. On the main machine floor are the planers, straightening machines, and special tools of various kinds, used in handling the rails for the manufacture of railway frogs. The second crane supplies the erecting floors and machines with material from the stock department which is located just beyond the erecting floor. In this department, a space 60x380 feet, enclosed by a fence, is kept all material received in the shops. The forge department, in the south bay, is equipped with forging machines, presses, hammers, heating furnaces, etc. In the north bay and opposite the forge department, the special tools for bending, curving and drilling rails are located.

The power plant consists of a 500 H. P. automatic compound

INTERIOR OF ERECTING AND MACHINE SHOP WEIR FROG CO.

engine, direct coupled to a 300 K. W. Allis-Chalmers direct current generator, 220 volts. Every machine tool in the shop, with the exception of a few small machines taking power from two lines of motor driven shafting, is driven by a separate Allis-Chalmers Type "N" direct current motor. A steam driven air compressor furnishes 500 cubic feet of free air per minute at 90 pounds pressure, for the operation of pneumatic reamers, drills and riveters, and also for the operation of pumps.

The boiler room is equipped with two 250 H. P. water tube boilers fitted with mechanical stokers. An artesian well, 320 feet deep, supplies all water used on the premises. It is pumped by compressed air pumps to a storage tank 60 feet above ground,

with 20,000 gallons capacity. Water for the boilers is softened, then filtered and heated in an exhaust steam heater. The floors of the filter and boiler room are ten feet below the level of the engine room floor and eight feet below the ground level. The coal is received in hopper cars and dumped directly to the boiler room floor. The floors of the erecting and main machine shops are of concrete. The heating system utilizes exhaust steam from the engines for heating coils of pipes over which air is blown and distributed throughout the buildings.

A noticeable feature in the accompanying illustration is the light, open construction, free from the maze of line shafts, belts and pulleys, due to the use of the motor drive to machine tools. The motors used were built at the works of the Allis-Chalmers Company, Cincinnati.

Track Ballast that Assays $2 a Ton Gold

Passengers on the new Belen cut-off of the Santa Fe will ride over a gold mine nearly all the way!

The ballast used on that line assays $2 worth of gold to the ton—equal to $9,000 a mile.

That's only one of the many interesting items about that line.

A saving of several hours, as compared with present schedule of its fastest Chicago and Los Angeles trains, is what the Santa Fe hopes to achieve by the Belen cut-off, otherwise known as the Eastern Railway of New Mexico, which is being built from Texico to Rio Puerco, 270 miles, and to be open for business early next year. Construction trains now carry passengers seventy-two miles from Texico to Sunnyside.

This cut-off does not shorten the California line to any appreciable extent. The saving in distance is only eleven miles. Its importance lies in eliminating the heavy grades of two mountain ranges. The highest point on the new line is at Abo Pass, 6,492 feet, as against 7,608 feet and 7,421 feet for Raton and Glorieta passes.

If it should be decided to run the swift California Limited by way of Texico over this slightly shorter line. it is estimated that the time between Chicago and California can be lessened at least five hours. The greatest economy in time will result in the freight service. The fast freight will save, at the lowest estimate, twenty-four hours, besides carrying a heavier tonnage and reducing operating expenses accordingly. No one knows yet just what California trains will run over the new route, but it is safe to say that when the track is in proper shape at least some of them will go that way.

There will then be practically two main lines on the Santa Fe System between Florence or Newton, in Kansas, and Rio Puerco, in New Mexico. The roadbed from Florence to Texico will be entirely reconstructed by laying eighty-five-pound steel rails, reducing the grades and reballasting. At the Canadian River crossing a new steel bridge is being put in and eleven miles of new track. The fast through passenger and heavy freight trains for California can take the shorter of the two routes over the Pecos Valley branch of the Santa Fe, traversing the Panhandle section of Texas. Leaving that line at Texico, the run will be made over the track now building between that point and Rio Puerco.

The new line is being constructed at a cost of nearly $10,000,000. The roadbed is twenty-eight feet wide, so that double tracks may be laid, if required. Construction was begun at opposite ends simultaneously. These ends are now only seventy miles apart. The Eastern section is operated as far west as Sunnyside; at this point the Santa Fe is building a fine steel bridge—1,100 feet long, 70 feet high, with eleven 100-foot girders set in solid masonry piers. It will require at least a year longer to fully build this part of the work, though operation of the southern section will probably commence within a few months. A temporary track is being laid at a point not far from this bridge. Where the Santa Fe crosses the Rock Island a double-track arch 40 feet high carries the trains of the former road over the roadbed of the latter.

Besides shortening the time between Chicago and Los Angeles, important relief will be afforded California freight traffic by doing away with the necessity of breaking up long trains into sections while crossing the Raton and Glorieta passes.

The maximum grade by the Belen route is only 0.6 per cent, as against 3.50 per cent by way of Raton; the curves are also much easier, the maximum being 3 degrees, except in Abo Canyon, where there are several 5 degree curves.

An interesting feature of the new line is the fact that the stations are to be constructed of concrete, and the style of architecture will be Old Mission. Dwellings constructed of concrete are most desirable in a semi-tropical climate. The style of architecture adopted insures comfort as well as beauty.

At division points the roundhouses, storehouses, shops, reading-rooms, coal chutes and ice plants will be built of concrete.

Harvey station hotels and dining-rooms will also be installed.

In keeping with the architecture is the giving of Spanish names to most of the stations. From Texico westward they are as follows: Clovis, Blacktower, St. Vrain, Melrose, Cantara, Idria, La Lande, Sunnyside, Agudo, Ricardo, Gillespie, Yesso, Largo, Buchanan, Cardenas, Duoro, Casans, Iden, Vaughn, Vaughn Junction, Carnero, Cibolo, Dunmoor, Lucy, Pato, Broncho, Mountainair, Abo, Bodega, Madrone, Filipe, Rio Puerco.

The plan is to have side tracks every seven miles, each three-quarters of a mile long.

Settlers are already pouring in by way of Texico and taking up land for farms. A vast watersheet is found underneath the plains section, thus making possible irrigation by artesian wells and by windmills. There will be several good towns along this line.

Notes of the Month

The Bavarian Government has decided to take over on January 1, 1909, the 500 miles of private railways in the Palatinate, at a cost of $60,000,000.

The Missouri, Kansas & Texas Ry. is said to favor the adoption of the "Rueping" process of tie treatment, which is a slight modification of the general type of creosoting ties.

The viceroy of Canton and the board of commerce have decided to build a railway, according to the North China Herald, between Nauhsiung and Canton, and are starting the preliminary arrangements.

On May first the well known firm of Geo. P. Nichols & Bro., manufacturers of electric drawbridge machinery, electric turntable tractors, electric traveling cranes, and electric transfer tables, will move their office to 1090 Old Colony Bldg., Chicago. This change was necessitated on account of the increase of their business which has outgrown their former space.

John F. Allen, manufacturer of the "Allen" pneumatic riveters, reports recent sales abroad to Charles G. Eckstein, Berlin, Germany, one jaw riveter; John Turnbull, Jr., & Sons, Glasgow, one jaw riveter and one 72 in. boiler riveter; also to the Atlantic, Gulf & Pacific Company for contract in Manila, P. I., four jaw riveters of 72 in. reach, capacity 5/8 in. and 1 in. rivets. The machines for Manila are to be shipped next month.

Consul Deal, of St. Johns, advises that the Canadian freight association have made a change in their constitution, making it impossible for the American railways that have no terminals in Canada to have local standing in the organization. The association also adopted the American system of the haulage of combustibles, thus obviating the necessity of having a person accompany each car loaded with explosives from the factory to its destination.

The Preservation of Structural Steel and Iron is the title of a neat booklet issued by the Chicago Graphite Mfg. Co., Railway Exchange, Bldg., Chicago. This is a work of art in the bus-

inesslike and clear way of explaining and illustrating the protecting qualities of graphite for structural work. Some of the illustrations of buildings protected by the Chicago Graphite Mfg. Co.'s graphite paint are the Chapel, Naval Academy, Annapolis, Fidelity & Guaranty Co. Bldg., Baltimore, Md, elevated railroads, bridges, office buildings, etc.

The Russian Government announces the opening of the new St. Petersburg-Vologda Railway, while construction of the new direct line from Perm to Cheliabinsk has been begun. The journey from Siberia to the Baltic will then be shortened 226 miles, affording a regular annual exit for Siberian grain via St. Petersburg. Even now the new line curtails the distance to Vologda (as also to Archangel) by 166 miles. The new Vologda-Viatka Railway has also been opened for traffic. On the new Orenburg-Tashkend Railway regular traffic extends to Kubek, and will probably be open through by spring.

The 1906 Catalogue of Purdue University has been received at this office and shows for the past year an enrollment, including the Schools of Medicine at Indianapolis, of some 2,000 representing 46 different states and countries. This university offers excellent courses in Mechanical, Civil and Electrical Engineering, not to mention Science, Medicine, Agriculture, Pharmacy. In the Civil Engineering School the Railroad work taken up is conceded to be equal to any in the country. Since the last catalogue has been issued a large and well equipped Physics building has been completed, a new Civil Engineering building is nearing completion and bids for a Chemistry building have been asked for.

The Joseph Dixon Crucible Company, Jersey City, issue a little pamphlet entitled Spring Painting, which sets forth the reasons why nature's own product in the forms of Dixon's Silica-graphite paint is the best pigment for resisting the destructive chemical action of oxygen on all metal structures, and is therefore a medium that railways cannot safely ignore, since it is especially valuable for the preservation of steel cars, bridges, and any other metallic construction. The silica, which is a component part of the flake graphite, being unchangeable by gases or atmospheric conditions, is the basis for the claim that Dixon's Ticonderoga flake graphite forms an unequalled preservative for structures of all kinds.

Consul Norton reports from Smyrna that the purchase of the Mersina-Adana Railway by the Anatolian Railroad Company means the increasing importance of Mersina as a seaport, through which will flow the trade of Mesopotamia and the upper Euphrates Valley. The Anatolian line is now in operation from the docks at Haidar Pasha, opposite Constantinople, via Afioun Kara Hissari, Konieh, and Eregli to Bulgurlu, a distance of nearly 500 miles, and within 75 miles of Adana, where it will connect with the newly acquired line to Mersina. From Adana the railroad will push on toward Bagdad. Trade now finding an outlet at Alexandretta will naturally be diverted to the railroad port of Mersina, or hurried by rail to Haidar Pasha, ferried across the Bosphorous, thence to the Oriental railway running northward to Vienna, etc. Smyrna may also come in for a larger share of this Asiatic trade, as railroad connection exists between Smyrna and Afioun Kara Hissari on the Anatolian railway. The new dock construction of Smyrna, rapidly nearly completion, will provide for an enormous volume of traffic. Consul Norton also states that the new French railway from the port of Beirut to Aleppo will be finished within a year. The Anatolian Company will also build a branch south to Aleppo from their main railway to Bagdad. Beirut is also the terminus of the present line to Damascus, which is extending to Mecca. Great progress is being made in the construction of the Hedjas Railway, which is now open to traffic as far as Minlavere, a point 150 kilometers beyond Ma'an, reports the Levant Herald. The Dera-Haifa branch is in full working order, and this, together with the main line, makes 733 kilometers over which the trains now run. The earthworks have been pushed beyond Mundavere, and the survey has been completed as far as Medain Salih, 950 kilometers from Damascus, or considerably over halfway to Mecca. The Herald adds that the Imperial Government intends to establish big engineering works, probably at Damascus, in connection with the railway, and has ordered the necessary plant.

Special Agent Hutchinson has made an investigation of trade conditions in Bolivia of which the following is a partial report:

"The great obstacle, however, to the development of the rich natural resources is the lack of transportation facilities in the forest region and the lack of both transportation facilities and power in the mining regions. The first steps to be taken must be to secure these accessories to development or the development cannot take place. These two needs then, for transportation facilities and for power, will create the greatest demand for foreign capital in the near future. The Bolivian Government has, within the past few years, turned its attention especially to the development of transportation facilities. By the Acre treaty with Brazil Bolivia secured an indemnity of between $10,000,000 and $11,000,000 United States gold, which is to be devoted to the building of railroads. The preliminary surveys were begun by a large party of American engineers a year or two ago and are still being pushed rapidly in spite of interruptions caused recently by certain most unfortunate misunderstandings and quarrels among the members of the engineering commission. It is too early as yet to state with perfect definiteness what roads are to be constructed, but the following is an approximate outline of the plan:

It is proposed to build about 1,000 miles in all, consisting of five "main lines" with branches. The main lines and approximate lengths are:

	Miles.
From Viacha (a station near La Paz on the existing line from La Paz to Guaqui) to Oruro (present terminus of the line which runs from Bolivia to the coast at Antofagasta.)	135
From Ororu to Potosi.	200
From Potosi southward to Tupiza (this line will eventually connect with the Argentine line, which has already reached a point north of Jujuy.)	150
Yungas line (from La Paz eastward into the Department of Yungas.)	200
Cochabamba line (from Oruro to Cochabamba.)	130
The "branch lines" are:	
To connect the Yungas line with La Paz	10
To connect the Viacha-Oruro line with Corocoro	45
To connect the Oruro-Potosi line with Colquechaca	20
To connect the Oruro-Potosi line with Sucre	70
To connect the Potosi-Tupiza line with Porco	20
To connect the Potosi-Tupiza line with Chorolque	20
Total.	1,000

Considerable modifications have already been made in the original proposals, and more are likely to be made as the work of the preliminary survey progresses, but the foregoing list gives a sufficiently clear idea of the general nature of the plan, which is to connect the mining centers with already existing lines, to join the railway system of Bolivia with that of Argentina, which is advancing from the south, and to get an outlet to the eastward to the great Amazon waterways, through the Territory of Yungas. The total cost of the work has been estimated at a little less than $40,000,000. Of this amount Bolivia already has between ten and eleven millions, received from Brazil. Various proposals have been made for borrowing the remaining or such portions of it as can be negotiated on reasonable terms.